Halon Alternatives Testing in Combat Vehicle Engine Compartments

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Historically fire suppression testing and live fire vulnerability testing for the Army has been conducted by the U.S. Army Aberdeen Test Center (ATC), at Aberdeen Proving Ground, MD. This testing ensures the safety and reliability of equipment being issued to DOD personnel. These tests have often shown the need for vehicle redesign to enhance crew survivability. An area of special emphasis has been assessing the reliability and performance of Automatic Fire Extinguishing Systems (AFES). AFES tests may be conducted on an entire system or on single components such as a sensor.

Halon 1301 has been the fire suppression agent of choice because of its ability to effectively control fires at concentrations which will not adversely impact the crew. Therefore, it is widely used in occupied spaces of combat vehicles, watercraft, and aircraft. Halon 1301 is also used because of its excellent handling qualities over a broad range of conditions and its ease of distribution. These same characteristics have caused Halon to be used in a variety of civilian applications such as computer room asset protection and civil aviation. Unfortunately recent scientific studies have linked the release of Halon 1301 with depletion of the stratospheric ozone layer. The U.S. Army Acquisition Pollution Prevention Support Office (AAPPSO) is seeking alternatives for all Ozone Depleting Chemicals currently used by the Army. The Program Manager for Armored Systems Integration (PM-ASI) in cooperation with the Tank-Automotive Research Development and Engineering Center (TARDEC) is overseeing the Halon replacement program for ground combat vehicles.

Typically fire suppression testing has been divided into two separate types: those fires which occur during peacetime and those which result from perforations by overmatching threat munitions during time of war. Fires occur in one of two distinct areas of the vehicle, the crew compartment and the engine compartment. This separation is made because peacetime fires usually occur in the engine compartment as a result of electrical shorts or fuel line rupture and crew compartment fires usually result from perforating impacts during combat. Halon 1301 is currently used in the engine and crew compartment AFES as well as hand held fire extinguishers (HHFE).

TARDEC has requested that ATC conduct a series of test programs demonstrating the performance of Halon 1301 replacements in the engine and crew compartments of ground combat vehicles as well as HHFE. The engine compartment program has been going on much longer due to the fact that the Army has designated only the crew compartment as a mission critical use for

Halon 1301. Therefore there is a more pressing need to find an alternative agent for the engine compartment.

This engine compartment test program is to be conducted in four major phases. Phases I and II were conducted by ATC in two modified M60 tank fixtures over a two year period. Phase I testing was conducted using a non-operational power pack and Phase II was conducted using an operational power pack. Fourteen potential replacement agents were studied in Phase I, while only four candidates proceeded to Phase II. The objective of these phases was to screen potential Halon 1301 replacement agents quickly and economically. Tests were conducted using bilge and simulated fuel spray fires with and without airflow. The result of these phases was a narrowing of the potential field of alternate agents down to two candidates: FM-200 and a dry chemical system.

Phase III testing consists of refining the alternate agent delivery system for individual vehicles using the two replacement agents still under consideration. Separate test programs are being set up by the individual vehicle program managers. The first two vehicles, the M1 Abrams Main Battle Tank and the M2 Bradley Infantry Fighting Vehicle, are currently undergoing testing. The end result of Phase III will be a decision on which of the two agents still under consideration to use.

Once a single agent is chosen, a limited ballistic validation test will be conducted at ATC. In this phase of testing, actual anti-tank weapons will be fired to impact the fuel tanks of operational M60 and M1A1 Main Battle Tanks. All of the tests conducted in the previous phases used peacetime fire scenarios. The results of this testing will indicate whether agent delivery systems intended to suppress non-ballistically initiated fires will be effective against the types of fires expected to be encountered in combat.

Testing on replacement agents has proceeded rapidly and economically while allowing for maximum participation by all potential solutions. The Army has a milestone decision date for acquisition of new agents and agent delivery systems for the affected vehicle systems in Fiscal Year 97.